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EXAMINER	
HO, ALLEN C	

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 10/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/814,992	DEYCH ET AL.	
	Examiner	Art Unit	
	Allen C. Ho	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4,5,7-16,18 and 20-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *16,18 and 20-22* is/are allowed.

6)☒ Claim(s) *1,4,5 and 7-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 1 is objected to because of the following informalities:

   (1) Line 2, "the object" should be replaced by --an object--.

   (2) Claim 1 recites the limitation "the x-ray exposure period". There is insufficient antecedent basis for this limitation in the claim.

   Appropriate correction is required.

2. Claim 4 is objected to because of the following informalities:

   Claim 4 depends on a canceled claim.

   Appropriate correction is required.

3. Claim 8 is objected to because of the following informalities:

   (1) Claim 8 depends on a canceled claim.

   (2) Claim 8 recites the limitation "said x-ray imaging sysetm". There is insufficient antecedent basis for this limitation in the claim.

   Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

   The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1, 4, 5, and 7-15 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for determining operating voltage between a cathode and an x-ray emissive target, does not reasonably provide enablement for determining the operating voltage for other components in an x-ray apparatus. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

Claim 1 recites "operating the x-ray apparatus at said first operating voltage level kVp_0" in step B, "operating said x-ray apparatus at said second operating voltage level KVp_1" in step D, and "setting the operating voltage level of the x-ray apparatus to said optimal value KVp_2" in step E. Claim 4 recites "determining the optimal values of one or more additional x-ray exposure parameters of the x-ray apparatus". The specification only discloses determining and setting operating voltages between a cathode and an anode in an x-ray tube. The specification does not enable any person skilled in the art to determine operating voltage for other components, such as an x-ray detector or a controller.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 4, 5, 7, 8, and 11-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Unger *et al.* (U. S. Patent No. 6,501,819 B2).

With regard to claim 1, Unger *et al.* disclosed a method for optimizing radiographic image quality by irradiating an object with x-rays from an x-ray apparatus (**200**) during an initial period of an x-ray exposure, the x-ray apparatus including an x-ray source configured to generate x-rays directed toward and through the object, the x-ray source including an electron source and an x-ray emissive target (It is recognized in the x-ray field that an x-ray source, which is characterized by operative parameters voltage (kV) and current (mA), comprises an electron source and an x-ray emissive target.), the method comprises:

A. determining a first operating voltage level kVp_0 (default exposure settings 50 -150 kVp) of the x-ray source for initial operation of the x-ray apparatus (column 4, lines 7-14);

B. during a first sampling interval Δt_1 in the beginning of an x-ray exposure period (the period for acquiring n images, column 8, lines 25-27), operating the x-ray source at the first voltage level kVp_0 and using one or more sensors (**220**) to detect x-rays that have passed through at least a portion of the object during the interval Δt_1 (a first image, column 4, lines 7-14), wherein the first sampling interval Δt_1 is relatively small compared to the x-ray exposure period (This is necessarily so since the x-ray exposure period comprises the first sampling interval Δt_1.);

C. after the first sampling interval Δt_1, processing the output signals from the sensors to determine a second operating voltage level kVp_1 (column 5, lines 22-33);

D. during a second sampling interval Δt_2 within the same x-ray exposure period, operating the x-ray source at the second voltage level kVp_1 and using the sensors to detect x-rays that have passed through at least a portion of the object during the interval Δt_2 (a second image,

column 5, lines 34-36), wherein the second sampling interval Δt_2 is relatively small compared to the x-ray exposure period (this is necessarily so since the x-ray exposure period comprises the second sampling interval Δt_2);

E. after the second sampling interval Δt_2, processing the sensor output signals to determine an optimal value kVp_2 for the operating voltage level, and setting the operating voltage level of the x-ray source to the optimal value kVp_2 for the remainder of the x-ray exposure period (adjusting exposure settings of 3rd image based on 2nd image, column 8, lines 25-27).

With regard to claims 4 and 5, Unger *et al.* disclosed a method in accordance with claim 1, further comprising: determining the optimal values of additional x-ray exposure parameters comprising x-ray tube current (column 5, lines 30-33).

With regard to claim 7, Unger *et al.* disclosed a method in accordance with claim 1, wherein the object comprises anatomical tissue of a patient, and wherein the optimal value of the operating voltage are chosen so that the patient's exposure is substantially minimized when the x-ray apparatus is operated at the optimal value (column 8, line 67 - column 9, line 1).

With regard to claim 8, Unger *et al.* disclosed a method in accordance with claim 2, wherein the x-ray imaging system comprises a flat panel detector (**220**).

With regard to claim 11, Unger *et al.* disclosed a method in accordance with claim 1, wherein the object comprises anatomical tissue of a patient, and further comprising the step of measuring the thickness of the tissue before the step of determining the first and second operating voltage levels (column 6, lines 15-26).

With regard to claims 12 and 13, Unger *et al.* disclosed a method in accordance with claim 11, wherein determining the optimal values of the additional x-ray parameters comprises:

A. calculating the differential attenuation coefficient $\Delta\mu$ of the exposed tissue at the voltage kVp_1, based on the output signals from the sensors, and based on the measured thickness of the tissue (column 6, line 65 - column 7, line 13);

B. creating at least one $\Delta\mu$ table for at least one region of the object (column 7, lines 41-60).

C. determining the composition of the tissue using the calculated value of $\Delta\mu$ and the at least one $\Delta\mu$ table (column 8, lines 53-64); and

D. determining the optimal value of the operating voltage level using the tissue composition and the $\Delta\mu$ table (triple energy imaging, column 8, lines 23-27).

With regard to claim 14, Unger *et al.* disclosed a method in accordance with claim 4, wherein determining the optimal values of the additional x-ray parameters comprises:

A. calculating the differential attenuation coefficient $\Delta\mu$ of the exposed tissue at the voltage kVp_1, based on the output signals from the sensors, and based on the measured thickness of the tissue (column 6, line 65 - column 7, line 13);

B. creating at least one $\Delta\mu$ table for at least one region of the object (column 7, lines 41-60).

C. determining the composition of the tissue using the calculated value of $\Delta\mu$ and the at least one $\Delta\mu$ table (column 8, lines 53-64); and

D. determining the optimal value of the operating voltage level using the tissue composition and the $\Delta\mu$ table (triple energy imaging, column 8, lines 23-27).

With regard to claim 15, Unger *et al.* disclosed a method in accordance with claim 1, wherein steps B and C are repeated for a plurality of n sampling intervals during which the x-ray apparatus is operated at corresponding operating voltage levels, so that the optimal voltage level kVp_2 is determined based on sensor output signals generated while the x-ray apparatus was operated at voltage level kVp_1^n during a sampling interval Δt_1^n (column 8, lines 25-27).

Allowable Subject Matter

8. Claims 16, 18, and 20-22 are allowed.

9. The following is a statement of reasons for the indication of allowable subject matter:

With regard to claims 16, 18, 20-22, the prior art disclose an x-ray imaging apparatus that comprises: an x-ray source including an electron source configured to emit electrons and an x-ray emissive target configured to emit x-rays from a focal spot within the target in response to incident electrons that have been accelerated from the electron source toward the target at an operating voltage of the x-ray source; an x-ray imaging system configured to receive x-rays that have been emitted from the x-ray source and that have passed through an object, and to generate an image of the object from the received x-rays; one or more sensors disposed between the object and the x-ray imaging system, the sensor being configured to detect x-rays from the x-ray source that have traversed the object; a processor configured to determine an operating voltage level of the x-ray source; and a controller configured to adjust the operating voltage of the x-ray source. However, the prior art fails to disclose a processor that is configured to determine a first operating voltage level kVp_0 of the x-ray source for an initial operation of the x-ray apparatus during a first sampling period Δt_1, the processor being further configured to calculate, after the

first sampling period Δt_1, a second operating voltage level kVp_1 of the x-ray source by processing the output signals generated by the sensors during the first sampling period, the processor being further configured to calculate, after the second sampling period Δt_2, an optimal operating voltage level kVp_2 of the x-ray source by processing the output signals generated by the sensors during the second sampling period as claimed.

Response to Arguments

1. Applicant's arguments filed 10 October 2006 with respect to claim 18 have been fully considered and are persuasive. The rejection of claim 18 under 35 U.S.C. 112, second paragraph, has been withdrawn.

1. Applicant's arguments filed 10 October 2006 have been fully considered but they are not persuasive.

The applicants argue that Unger *et al.* disclosed two or more separate x-ray exposure periods. The examiner respectfully disagrees with this characterization. Unger *et al.* disclosed an x-ray exposure period that comprises (n-1) sampling intervals (column 8, lines 23-27). Furthermore, the applicants argue that Unger *et al.* failed to disclose determining an optimal value for the operating voltage level after a second sampling period and setting the operating voltage level of the x-ray source to the optimal value for the remainder of the x-ray exposure period. The examiner respectfully disagrees. Unger *et al.* specifically disclosed a method of adjusting exposure settings that comprises determining an operating voltage level based on a previous image and setting the operating voltage level of the x-ray source for the next image (column 5, lines 22-33; column 7, line 41 - column 8, line 14).

Conclusion

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

(1) Maack *et al.* (U. S. Patent No. 6,920,201 B2) disclosed an x-ray device with storage for x-ray exposure parameters, the x-ray device comprises a sensor (**4a**) positioned between an object (**5**) and an x-ray imaging system (**4**).

(2) Yamazaki *et al.* (U. S. Patent No. 6,944,266 B2) disclosed an x-ray imaging apparatus that comprises a sensor (**12**) positioned between an object (**2**) and an x-ray imaging system (**5**).

(3) Nonaka (U. S. Patent No. 6,516,098 B2) disclosed an apparatus that comprises a sensor (**15**) positioned between an object (**12**) and an x-ray imaging system (**22**).

(4) Gingold *et al.* (U. S. Patent No. 6,327,336 B1) disclosed radiographic system that comprises a sensor (**22**) positioned between an object and an x-ray imaging system (**10**).

(5) Nagai (U. S. Patent No. 6,208,710 B1) disclosed an x-ray diagnostic apparatus that comprises a sensor (**3**) positioned between an object (**200**) and an x-ray imaging system (**4**).

(6) Hunter *et al.* (U. S. Patent No. 6,192,105 B1) disclosed an x-ray imaging system that comprises a sensor (**6**) positioned between an object (**4**) and an x-ray imaging system (**7**).

(7) Xue *et al.* (U. S. Patent No. 6,151,383) disclosed a radiographic system that comprises a sensor (**16**) positioned between an object (**10**) and an x-ray imaging system (**14**).

(8) Khutoryansky *et al.* (U. S. Patent No. 6,047,042) disclosed an automatic exposure and brightness control that comprises a sensor (**110**) positioned between an object (**116**) and an x-ray imaging system (**118**).

(9) Aichinger *et al.* (U. S. Patent No. 5,446,780) disclosed an x-ray apparatus that comprises a sensor (**9**) positioned between an object (**7**) and an x-ray imaging system (**10**).

(10) Beland (U. S. Patent No. 5,388,139) disclosed a high-voltage power supply that comprises a sensor (**43**) positioned between an object (**40**) and an x-ray imaging system (**44**).

(11) Aichinger *et al.* (U. S. Patent No. 5,150,393) disclosed an x-ray diagnostic system that comprises a sensor (**12**) positioned between an object (**4**) and an x-ray imaging system (**7**).

(12) Ochmann *et al.* (U. S. Patent No. 4,797,905) disclosed an x-ray generator that comprises a sensor (**3**) positioned between an object (**13**) and an x-ray imaging system (**5**).

(13) Griesmer *et al.* (U. S. Patent No. 4,748,649) disclosed a phototiming control that comprises a sensor (**20**) positioned between an object (**14**) and an x-ray imaging system (**19**).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allen C. Ho whose telephone number is (571) 272-2491. The examiner can normally be reached on Monday - Friday from 8:00 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Allen C Ho

Allen C. Ho, Ph.D.
Primary Examiner
Art Unit 2882

23 October 2006